Delias spp. (Lepidoptera:Pieridae) on Bottlebrush

METAMORPHOSIS

AUSTRALIA

Magazine of the Butterfly & Other Invertebrates Club

ISSUE NO: 99 DATE: DECEMBER 2020 ISSN: 1839-9819
Price $6.00 http://www.boic.org.au

Planning and Organizing Committee 2020

President:	Ross Kendall	07 3378 1187
Vice President:	Richard Zietek	07 3390 1950
Treasurer:	Rob MacSloy	07 3824 4348
Secretary:	Dawn Franzmann (secretaryboic@gmail.com)	07 3325 3573
Magazine:	Daphne Bowden (daphne.bowden1@bigpond.com)	07 3396 6334
Committees Members:	David Exton	0419 431 210
	Judy Burgess	

Planning and Organization Meetings

A quarterly meeting is scheduled in order to plan club activities and the magazine.
See BOIC Programme

Contact Address and Membership Details

PO Box 2113, Runcorn, Queensland 4113 – Email info@boic.org.au
Membership fees are $30 for individuals, schools, and organizations.

Aims of the Organization

- To establish a network of people growing butterfly host plants;
- To hold information meetings about invertebrates;
- To organize excursions around the theme of invertebrates e.g. butterflies, native bees, ants, dragonflies, beetles, freshwater habitats, and others;
- To promote the conservation of the invertebrate habitat;
- To promote the keeping of invertebrates as alternative pets;
- To promote research into invertebrates;
- To encourage the construction of invertebrate friendly habitats in urban areas

Magazine Deadlines

If you wish to submit an item for publication the following deadlines apply:
March issue – February 1st June issue – May 1st
September issue – August 1st December issue – November 1st
All articles should be submitted directly to the Editor daphne.bowden1@bigpond.com

ALL MATERIAL IN THIS MAGAZINE IS COPYRIGHT TO THE AUTHORS, ARTISTS, PHOTOGRAPHERS, AND THE BOIC.

Cover Photo Collage

Digitally composed by Peter Hendry from an image of a Bottlebrush species and several paintings of *Delias* species also by Peter Hendry
Clockwise from top left: *Delias nysa nysa*; *Delias argenthona argenthona*; *Delias lara lara; Delias harpalyce*; *Delias ennia nigidius*; *Delias aruna inferna*; *Delias mysis mysis*; *Delias aganippe* and near centre *Delias nigrina*

FROM THE PRESIDENT

As I write this, the annual "migration" of Caper White butterflies has again attracted the attention of the general public and the media. Butterflies certainly dominate the articles you will find in this our 99th edition.

What a smorgasbord follows! Peter continues his epic research with the opening chapter of his latest project, the colourful *Delias* genus of butterflies, while he concludes the final chapter on the very diverse *Charaxes* genus; Wesley adds another of his excellent accounts of the life histories of many Australian species of butterflies; Douglas presents some images of butterflies from Iron Range on Cape York Peninsula; Roger reminds us of the tremendous contribution of others in the past.

While Geoff Monteith is well known in the world of entomology, we thank Dawn for giving us a glimpse of his life work which I am sure will lead to his addition to the pantheon of entomological legends.

The book reviews by Gary Wilson, Chris Lambkin and Peter Hendry can only whet our thirst for more reading.

I thank Dawn again for her great work in the production of "NewsBOIC" which has been an excellent means of keeping us open to the colourful world which did continue to exist during the dismal virus episode.

Best wishes *Ross*

IN THIS ISSUE

The genus *Delias* (Lepidoptera: Pieridae) – a look at the Australian species from an historical perspective and an overall view of the world taxa 4
Butterflies of Iron Range National Park 11
Leps in Books: Michael Parsons and the Butterflies of Papua New Guinea 13
Alfred Russel Wallace and the Birdwing of Batchian 18
Life history notes on the Scarlet Jezebel, *Delias argenthona* (Fabricius, 1793) 19
Dr Geoff Monteith Listed in the Top Ten Scientist List 23
The genus *Charaxes* (Lepidoptera: Nymphalidae) a look at the Australian species 26
Book Reviews - The Invertebrate World of Australia's Subtropical Rainforests 43
The inside out of flies 45
Moths of Victoria Vol 9 47
Seed Bank 48

The genus *Delias* (Lepidoptera: Pieridae) – a look at the Australian species from an historical perspective and an overall view of the world taxa – *Peter Hendry*

The genus *Delias* was erected by Jacob Hübner, a German entomologist, in 1819 in *Verzeichnis bekannter Schmetterlinge*. The type species is *Papilio egialea* Cramer, 1777. Cramer described and figured the male (Fig. 1) of his species in *De uitlandsche Kapellen voorkomende in de drie Waereld-Deelen Asia, Africa en America* part 2 and the female (Fig. 2) in part 3, wherein he acknowledged the similarities to Linnaeus's 1758 *Papilio pasithoe*. Today Cramer's species is now considered a subspecies of Linnaeus's species, being *Delias pasithoe egialea*.

Fig. 1 *Delias pasithoe egialea* ♂r *Delias pasithoe egialea* ♂v

Fig. 2 *Delias pasithoe egialea* ♀ r *Delias pasithoe egialea* ♀ v

Delias belong to the butterfly family Pieridae, subfamily Pierinae, tribe Pierini, Subtribe Aporiina. They are commonly known as "Jezebels" after a Phoenician princess who married King Ahab of Samaria, the northern kingdom of Israel. She enforced her Baal religious beliefs over those of the Yahwism faith and many were killed. The common name alludes to the fact that the *Delias* are more beautiful on the outside (underside). The underside of most species is generally black and/or white, with red and yellow markings, usually on the hindwings, while the upperside is

generally a plain white or yellow with black edges. Talbot, 1927 noted that Evans, 1927 [1923] was the first to call the *Delias* "Jezebels", using the spelling "Jezabels" an error that was followed by Waterhouse, 1932 but spelt correctly by Corbet and Pendlebeury, 1934.

The distribution as given by Braby and Pierce, 2007 is as follows: "The geographical range extends from the southern slopes of the Himalaya (Kashmir, Nepal, Sikkim, Bhutan, northern India)..... south-eastern China (including the eastern edge of Tibet) and Taiwan, through Central and South-East Asia, including the Malay Peninsula, the Philippines and Indonesia, to mainland New Guinea and Australia, reaching its easternmost limits on the Solomon Islands, Vanuatu and New Caledonia....". The majority of species occur within mainland New Guinea. Braby and Pierce, 2007, put forth the hypothesis based on phylogenetic evidence of an 'out-of-Australia' origin for the genus.

As mistletoes are the chief host plants of *Delias*, I must state that this article recognises Viscaceae as a synonym of Santalaceae as per the online Australian Plant Name Index. With only about 11% of the hostplants known, Braby, 2006, notes that *Delias* feed chiefly on parasitic mistletoes and root parasites in the families Loranthaceae and Santalaceae with Loranthaceae the most widely used. The non-mistletoe family Euphorbiaceae is rarely used.

There are ten species recorded from Australia, five of which are represented by two subspecies giving the total number of Australian taxa as fifteen. Putting a definitive number on the world taxa is an impossible task for several reasons; one is simply the fact that there are bound to be more to find; another is the constant revision of this complex group, in which species are being sunk to subspecies level and subspecies are being raised to species level while others are being synonymised. There is also some disagreement between authors. To this end, for the statistics provided in this article, I have relied heavily on a list extracted from the "*Delias* of the World" web site (http://www.delias-butterflies.fr/index.html) accessed in April 2020. To this base list I have added the following; *Delias mysis waterhousei Talbot, 1937*; *Delias ottonia semperorum Schroeder & Treadaway, 2009*; *Delias hyparete noellindae Schroeder & Treadaway, 2009*; *Delias aestiva smithersi* Daniels, 2012; *Delias diaphana treadawayi* Badon & Jakusch, 2016; *Delias maaikeae* Davenport, Pequin & de Vries, 2017; *Delias agostina sushii* Lo, 2018 and *Delias clathrata parsonsi* Davenport & Grimaldi, 2019 and removed *Delias argentata* accepting it as a form of *D. hypomelas* and *D. flavissima giselae* accepting it as a synonym of *D. flavissima flavissima*. The result being 251 species and 415 subspecies bringing the total number of the world-wide taxa to 666. This does not include the many forms, aberrations and possible new subspecies listed on the "*Delias* of the World" web site.

The *Delias* have long been divided into species groups; Wallace, 1867, placed 57 species in 5 species groups; Mitis, 1893, placed 76 species in 8 species groups; Talbot (1928–1937) based on 153 species assigned 20 species groups and Yagishita, Nakano & Morita, 1993, based on 216 species assigned 22 groups. The discovery of *Delias*

brandti Müller, 2001, brought the number of species groups to 23 and with the extraction of *Delias aganippe* from the Belisama group, into a group of its own, by Braby and Pierce, 2007, the number of groups increased to 24. The world taxa in this article are set out using these 24 species groups based on morphological grounds. However, Müller, Matos-Maravi and Beheregaray, 2012, using molecular sequencing, extracted data from over half the world taxa, representing all recognized species groups and concluded that there were only 14 distinct groups. As their paper only assigned those species sequenced to their new groups it was not possible to place all the species dealt with in this article to their new positions within their newly assigned 14 species groups.

The Australian and Associated Taxa

Group III - Nysa Group: contains 15 species, with a total of 39 taxa, including subspecies. The following two taxa being the Australian representatives.

Fig. 3 *Delias nysa nysa* (Fabricius, 1775) Male recto, verso

Fig. 4 *Delias nysa nysa* Female recto, verso

Delias nysa nysa (Fabricius, 1775) (Fig. 3 ♂ r, v & Fig. 4 ♀ r, v) was originally named by the Danish zoologist Johan Christian Fabricius under the genus *Papilio*. It

was named from a specimen collected in 1770 by Joseph Banks, when he visited Australia on the Endeavour, captained by James Cook, exactly 250 years ago.

Fig. 5 Donovan's synonym *Papilio endora*

Donovan, 1805, described and illustrated (Fig. 5) the same species, thus the synonym, *Papilio endora* was created. Butler, 1869 noted "Donovan's figure is by no means characteristic". Fabricius placed *nysa* under the genus *Papilio* on several occasions, Fabricius 1781, 1787 and 1793. Then in 1819 Latreille & Godart placed *nysa* in the genus *Pieris* and this arrangement was followed by Boisduval, 1832, who noted "This genus is extremely numerous and should form new divisions". The genus *Pieris* was used again by Boisduval, 1836, while Wallace, 1867, placed *nysa* in Wallengren's genus *Thyca* (now a synonym of *Delias*). This arrangement was followed by Butler, 1869. Kirby, 1871, was the first to place *nysa* in the genus *Delias* but Kirby, 1879, in a catalogue he compiled of the Hewitson collection, referred *nysa* back to *Pieris*; this may have been based on label data. Butler, 1872, used *Delias*; Semper, 1879, also placed *nysa* in *Delias*, a position it has held since.

D. n. nysa, with a wingspan 45-50 mm, is endemic to Australia, occurring from eastern Victoria up the east coast to about Cooktown in north Queensland. It favours dry vine scrubs and the larva feeds on a species of *Korthalsella* (Santalaceae).

Delias nysa nivira Waterhouse & Lyell, 1914, is also endemic to Australia. It was described from 6♂ and 2♀ noted as from Coen, Cape York Peninsular, Queensland, however the data label of the type specimen shows Rocky River about 30k N E of Coen. It has a restricted distribution on the Cape from near Coen north to the Pascoe River. There are two other subspecies involved, the first is *D. n. santo* Talbot, 1937. The type location was given as New Hebrides (Vanuatu), West Santo (Espiritu Santo), Tataril. It was collected in November 1933 and was taken by the Oxford University Expedition. The other subspecies *D. n. caledonica* Nieuwenhuis & Howarth, 1969 was named from a single female taken on Mt. Koghi in New Caledonia in Dec. 1963.

Group XIII - Nigrina group: contains 12 species, with a total of 19 taxa, including subspecies. The following two taxa being the Australian representatives.

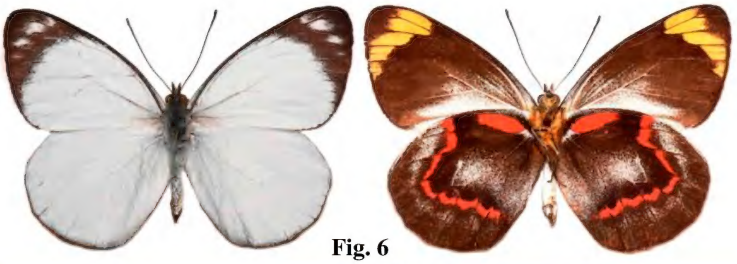


Fig. 6

Fig. 7

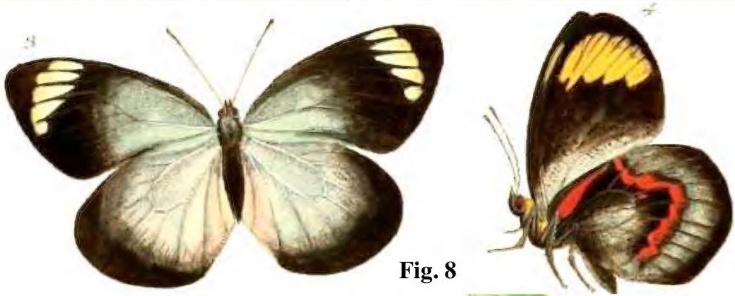


Fig. 8

Fig. 9

Delias nigrina (Fabricius, 1775)

Fig. 6: Male recto, verso Fig. 7: Illustration from Donovan, 1905
Fig. 8: Illustration from Hübner, 1821 Fig. 9: Illustration from Swainson, 1831-2

Delias nigrina (Fabricius, 1775) (Fig. 6 ♂ r, v) is another species collected by Banks in 1770. It was also illustrated by Dovanon, 1805 (Fig. 7 ♀ r: ♂ v, r) under the name *Papilio nigrina*. Its early history follows along the lines of *D. nysa*, with the exception of the female being illustrated (Fig. 8) by Hübner, 1821 under the genus *Symmachlas* (now a synonym of *Delias*) and the male illustrated (Fig. 9) by Swainson, 1831-32 under the genus *Pieris*. As with *nysa*, Kirby, 1871 was the first to place *nigrina* in the genus *Delias* and, as with *nysa*, he placed it in *Pieris* in his 1879 work on Hewitson's catalogue. Butler, 1872 used *Delias*; Semper, 1879 also dealt with *nigrina* placing it in *Delias*, where it has since remained.

D. nigrina, with a wingspan of c. 68 mm, occurs from eastern Victoria, north along the east coast to the tip of Cape York. The larva feed on several genera of Mistletoes in the family Loranthaceae.

There are forms of some *Delias* where the red markings are replaced by yellow, an example of this in *D. nigrina* is on the website below.

http://www.delias-butterflies.fr/groups/species-groups/group-xiii-nigrina-group/delias-nigrina/index.html

Fig. 10

Fig. 11

Delias harpalyce (Donovan, 1805) (Fig. 10 ♂ r, v): Edward Donovan was an Anglo-Irish illustrator, and amateur zoologist, he described and illustrated *D. harpalyce*, (Fig. 11) under the name *Papilio harpalyce*, from a specimen or specimens most likely collected in Sydney. It was referred to as *Pieris harpalyce* by Latreille & Godart, 1819, this was maintained by Boisduval, 1832 and 1836. A synonym under the name *Papilio lewini* was created by Thon, 1828. Wallace, 1867 referred it to the genus *Thyca* while Kirby, 1871 was the first to place *harpalyce* in the genus *Delias*, followed by Butler, 1872. Kirby, 1877 synonymized Thon's *Papilio lewini* with *Delias harpalyce*. Semper, 1879 used the genus *Delias* but Tepper, 1882 referred to it as *Pieris harpalyce*. This was followed by McCoy, 1885 who described and illustrated the larva and pupa as well as the adults (Fig. 12). McCoy actually used Wallengren's now synonymized genus *Thyca* as a subgenus by using *Pieris* (Thyca) *harpalyce*. Miskin, 1891 referred to it as *Delias harpalyce* the position it has held since.

Fig. 12

D. harpalyce, wingspan ♂ 74-86 mm, ♀ 82 -90 mm, occurs from the very S. E. of Queensland, south through the eastern half of New South Wales and over most of Victoria. The larva feed on several species of *Amyema,* and *Muellerina eucalyptoides* (Loranthaceae).

Photos Peter Hendry

To be continued

Butterflies of Iron Range National Park – *Douglas Dew*

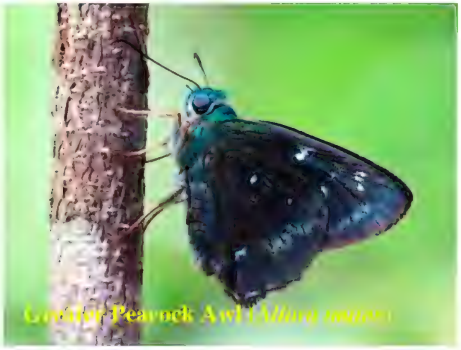
After spending the last 25 years photographing butterflies in their natural habitats throughout Victoria and along the east coast as far north as Port Douglas, the time had come to make a start on Iron Range National Park. With 290 species photographed (assuming my ID's are accurate), if I was ever going to push toward 350 and beyond, I had to start making numerous trips to this remote and unique part of the country.

Anyone with a copy of Michael Braby's "Butterflies of Australia" will know that the words 'Iron Range' are mentioned numerous times throughout the book and many species are only known from this part of Cape York. Some 60% of Australia's butterfly fauna have been recorded there.

Cyclone Trevor in March 2019 had certainly made its presence felt. The rainforest canopy had really been 'opened up' with many trees being stripped bare of leaves and numerous fallen trees creating large clearings throughout the forest. Whilst I appreciated the extra light this let in for my photography, I look forward to going back in years to come to see this place in its former glory.

I found that generally the butterflies were fairly localised, certainly more numerous along the creeks, but there was still a great variety to be found. It was such a thrill for me to finally see and photograph the many species I had been staring at for years in various butterfly field guides. Considering it was well into the dry season the butterfly fauna was still very impressive and I can only imagine how numerous and diverse it will be during the wet season.

The photographic highlight of my trip would have to be the Greater Peacock Awl (*Allora major*). The distribution of this species is represented by one tiny little dot on the Australian continent - Iron Range. It was high on my wish list and I only saw one over the six days I spent there. Fortunately, it perched in a great spot, right at head height, and was easily approached. The green background of the rainforest provided a perfect contrast to highlight its beauty.



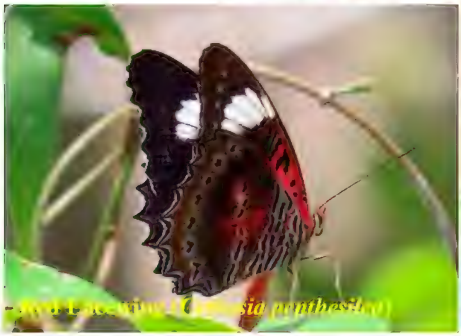
The challenge of finding and photographing these small insects within vast wilderness areas is what I enjoy most about the hobby and is something that will always continue to motivate me to expand my portfolio. I ended up photographing 12 new species on my trip taking my total to 302. A great result for the first of many trips I plan to make to Iron Range. I am already counting down the days, hours, minutes until I go back during the wet season.

Black-eyed Plane (*Pantoporia venilia*)

Australian Lurcher (*Yoma sabina*)

Blue Argus (*Junonia orithya*)

Chocolate Argus (*Junonia hedonia*)



Red Lacewing (*Cethosia penthesilea*)

Red Lacewing (*Cethosia penthesilea*)

Copper Jewel (*Hypocysops apelles*)

Yellow-eyed Plane (*Neptis praslina*)

Photos Douglas Dew

Leps in Books: Michael Parsons and the Butterflies of Papua New Guinea – *Roger Kitching*

The science of animal and plant distribution is called biogeography, emerging from the writings of von Humboldt, Darwin, Bates and other naturalist/travellers in the nineteenth century. It was a true nineteenth century genius, however, Alfred Russel Wallace, who codified the subject culminating in his masterwork *The Geographical Distribution of Animals* published in 1876. It is to Wallace that we owe the division of the globe into biogeographical 'realms' and the designation of our part of it as 'Australasia'. There is sometimes a temptation among Australian biologists to equate Australasia with Australia and, indeed, if land area alone was the key this would perhaps be justified (sorry, New Zealand!). Australasia, as conceived by Wallace, includes, in addition to Australia and New Zealand, the vast island of New Guinea and its surrounding archipelagoes, Timor and the Moluccas (that is: that part of the Indonesian archipelago east of Bali and south and south-west of Borneo). Wallace had difficulty placing the huge island of Sulawesi (then known as the Celebes) and, in the end, placed it in Australasia for no better reason than that its mammalian fauna included a small number of marsupials. We now understand more about the deep history of Sulawesi and its complex formation as a result of continental drift (inconceivable in Wallace's day) and volcanic activity. That, though, must remain a story for another day.

So, now, consider the Australasian butterflies. Thinking of the relative biological richness of the butterfly faunas of Australasia and including the more northerly regions in our thinking then any boast for Australian pre-eminence falls apart comprehensively. Australia has about 430 species of butterflies in a land area of 7.692 million square kilometres (that's about 17800 km^2 per species). For New Zealand it's hard to quote comparable figures simply because no one can tell us with confidence how many species of butterfly call New Zealand home. This is because a couple of genera (one lycaenid and one satyrine) seem to be in process of active evolutionary diversification and whether each slightly different isolated population represents a species, sub-species or merely a geographical 'form' depends on whether you're, taxonomically, a 'lumper' or a 'splitter'. If, like the position taken in the recent book by Patrick and Patrick (2012), you take these all to be full species then New Zealand can own a maximum of about 55 species in its 0.26 million square kilometres of land area (that's 4764 km^2 per species). All these figures, though, pale into insignificance when we think about the great Australasian island of New Guinea. New Guinea is home to about 950 known species of butterfly (with many others probably awaiting discovery). This is in a land area of 0.786 million square kilometres (about 819 km^2 per species).

Of course there are many obvious factors accounting for these differences – Australia's shape and vast arid interior, New Zealand's oceanic isolation and New Guinea's 'young' topography and tropical position, among many others. It does mean though that anyone interested in the butterfly fauna of Australia cannot ignore the rich

reservoir of diversity sitting just to our North – within easy flying distance for many of the more robust species.

Fortunately we have a superb set of literary resources available to us providing access to the vast New Guinea fauna – and almost all due to the labours of a single author, Dr Michael John Parsons. It is his three books on the butterflies of New Guinea (Papua New Guinea to be precise) that are the focus of this third article on 'Leps in Books'.

The richness and special nature of the New Guinea butterflies have been long appreciated. Alfred Russel Wallace himself collected extensively in the region (mostly on the offshore islands to the West of the principal land mass, but including one excursion to the north coast of the New Guinea mainland) and is renowned for his enthusiastic comments upon netting his first birdwing. Most of Wallace's extensive collections from those 1857-58 excursions ended up in the enormous collection of Baron Lord Rothschild, now a part of the even larger holdings of the London Natural History Museum (see BOX). Curiously, Wallace never visited Australia even though he prepared a later book entitled *Australasia: 1. Australia and New Zealand* (Wallace 1879). Many other collectors were active subsequently in New Guinea (outlined in detail by Parsons, 1999) including many based in Australia. Most of that material ended up in European museum collections. A couple of exceptions of particular interest for Australian lepidopterists were those made by the 'butterfly man of Kuranda', Frederick Parkhurst Dodd (Monteith 1991) during a five month visit to New Guinea in 1917. Some of this material featured in the display collection subsequently exhibited for many years at the Dodd home in Kuranda and taken, to great acclaim, twice, on tour around the eastern and southern states of Australia (Kitching & Edwards, 2020). Those display cases are held in the Queensland Museum (Monteith, 1991). William Waldemar Brandt, a Swedish entomologist who lived in New Guinea from 1949 until 1963 collected very extensively during that period. Ultimately based in Australia, Brandt's very extensive collections were deposited in the Australian National Insect Collection in Canberra.

Returning then to the topic of books about the butterflies of New Guinea. Parsons' works had a few notable predecessors. Adalbert Seitz's masterwork on the *Macrolepidoptera of the World* appeared between 1907 and 1940 originally in German but subsequently in English and French. Volumes 9-12 of the sixteen that make up this work were devoted to the Indo-australian fauna and the two parts of Volume 9 are about butterflies. They are illustrated copiously with fine colour lithographed plates and, until the 1970s this was perhaps the only work available that allowed many of the New Guinea (and other) species to be identified (although Evans', 1949, work on the skippers did cover some of the ground). Charles Barrett and Alan Burns' (1951) book on the *Butterflies of Australia and New Guinea* included, as the title suggests, some species from New Guinea but is highly selective and, although otherwise informative, is useful only for identification of only the commonest and most spectacular species.

Bernard D'Abrera's richly illustrated book, *Butterflies of the Australian Region* first appeared in 1971 (subsequent editions appeared in 1978 and 1990). A compendium of annotated photographs of mounted specimens, principally in the collection of the Natural History Museum, London, D'Abrera's work did include New Guinea species although not the skippers, which the author summarily dismissed as 'not butterflies'. Much active collecting and taxonomy of New Guinea butterflies was happening at about the same time and the book was challenging to use for identification of the New Guinea fauna.

Then, in 1979, Parsons appeared on the New Guinea butterfly scene.

He was appointed as a senior entomologist with the Insect Farming and Trading Agency, part of the Wildlife Division of the Papua New Guinea (PNG) government, the successor body to a similarly named organisation under the earlier colonial administration which had been established to control the unofficial and often exploitative (not to mention illegal) trading in insect specimens that had developed over the years. Parsons remained in PNG for four years and during that time played a major role in regularising the trade in New Guinea butterflies based both on wild collecting and on the products of so-called butterfly farms – village-based rearing and ranching businesses generating income streams for the locals. He also began an extended period of huge productivity in research and scientific writing.

Clearly during this period Parsons recognised the absence of (and need for) guidebooks to underpin the butterfly trade and to fill an obvious longstanding gap in the literature. His first book, *Papua New Guinea Butterflies* (Figure 1) was a short, 32 page, introduction to the New Guinea butterflies published by the Insect Farming and Trading Agency itself, illustrated by photographs, mostly of living insects, taken by Parsons.

Parsons departed PNG in 1983 and became a consultant, working in many tropical countries on insect conservation and butterfly farming. Initially based in Los Angeles, USA, he and his wife subsequently moved to Florida where Parsons then spent a decade working within academia at the University of Florida.

He continued working on the fauna of PNG, however, and in 1991, produced his first major work on the fauna. This was '*Butterflies of the Bulolo-Wau Valley*' (1991, Figure 2) describing and illustrating the 373 butterflies recorded from that tiny area of PNG. The focus on the Bulolo-Wau valley reflected the existence of the Wau Ecology Institute: a field station established by the Bishop Museum, Honolulu, in 1961. The Wau Ecology Institute hosted visiting researchers and local workers until its close in 2007. The Bishop Museum withdrew support for the Institute in 1973 and the station ran as an NGO until its close. From the point of view of the biological world at large, one of the most useful products of the Wau Institute was a series of handbooks describing aspects of the work carried out there. These handbooks ranged from field guides to groups of fauna and flora through to a compendium of biological terms in Melanesian pidgin. The Parsons' book was Handbook No. 12 and was

published by the Bishop Museum Press. It is an impressive 280-page work with 22 colour and 3 black and white plates.

Finally, in 1999, Parsons produced his masterwork, the large format volume *Butterflies of Papua New Guinea: their Systematics and Biology'* (Figure 3). This massive book (the word tome comes to mind) runs to 736 large format pages of text accompanied by 26 black and white plates illustrating genitalia, sex brands and characteristic damage patterns on host-plants. No fewer than a 104 colour plates follow, illustrating male and female upper and undersides of the adult butterflies. The final 35 colour plates show immature stages and living adults of selected species. The work was published by Academic Press of London and San Diego.

From a practical viewpoint this book enables identification of any butterfly described from Papua New Guinea and remains useful and critical for identification of material from surrounding regions. As a work of science and art it is unlikely to be surpassed any time soon. It may well also have been the inspiration (or challenge) for John Tennent's comprehensive and complementary work, *Butterflies of the Solomon Islands*, published in 2002.

The downside for *Butterflies of Papua New Guinea* is its current availability and likely cost. The book is now out-of-print and appears never to have had a very large print run. Originally sold for about A$350 (at least that is what I recollect my copy costing) a recent example sold at auction for US$500 and the only copy I can find currently available (on AbeBooks) has an asking price of an eye-watering US$1200.

Nevertheless, the work is available in major libraries and remains the key work on the butterflies of Papua New Guinea. The butterflies of the western half of the island, Indonesian New Guinea and its offshore islands, however, await their monographer.

The Parsons, meanwhile, have established their own Florida-based wildlife documentary film-making organization. They currently have four one-hour programmes ready for public release; with several more documentaries currently being filmed and edited.

Acknowledgement

I am most grateful to Dr Michael Parsons for his comments on an earlier version of this article.

References

Barrett, C. & Burns, A. N. (1951). *Butterflies of Australia and New Guinea.* N. H. Seward Pty Ltd., Melbourne.

D'Abrera, B. (1971). *Butterflies of the Australian Region.* Lansdowne, Melbourne.

Evans, W. H. (1949). *A Catalogue of the Hesperiidae from Europe, Asia and Australia in the British Museum (Natural History).* British Museum, London.

Kitching, R. L. & Edwards, E. D. (2020). Books about Australian moths 1805-2020: an annotated bibliography. *Australian Entomologist* **47**, in press.

Monteith, G. (1991). *The Butterfly Man of Kuranda: Frederick Parkhurst Dodd.* Queensland Museum, Brisbane.
Parsons, M. J. (1983). *Papua New Guinea Butterflies.* Insect Farming & Trading Agency Productions, Bulolo.
Parsons, M. J. (1991). *Butterflies of the Bulolo-Wau Valley.* Wau Ecology Institute Handbook #12, Bishop Museum, Honolulu.
Parsons, M. J. (1999). *Butterflies of Papua New Guinea: their Systematics and Biology.* Academic Press, San Diego & London.
Patrick, B. & Patrick, H. (2012). *Butterflies of the South Pacific.* Otago Museum, Dunedin.
Seitz, A. (1908). *The Macrolepidoptera of the World 9: the Rhopalocera of the Indo-Australian Faunal Region* (2 Volumes). Fritz Lehmann Verlag, Stuttgart.
Tennent, J. (2002). *Butterflies of the Solomon Islands: Systematics and Biology.* Storm Entomological Publishing, London.
Wallace, A. R. (1869). *The Malay Archipelago: the Land of the Orang-Utan and the Bird of Paradise. A Narrative of Travel with Studies of Man and Nature.* Macmillan & Co., London.
Wallace, A. R. (1876). *The Geographical Distribution of Animals with a study of the Relation of Living and Extinct Faunas as Elucidating the Past Changes in the Earth's Surfaces* (2 Volumes). Macmillan & Co., London.
Wallace, A. R. (1879). *Australasia: 1. Australia and New Zealand.* Edward Stanford, London.

Figure 1. Cover of Parsons' *Papua New Guinea Butterflies* (1983)

Figure 2. Cover of Parsons' *Butterflies of the Bulolo-Wau Valley* (1991)

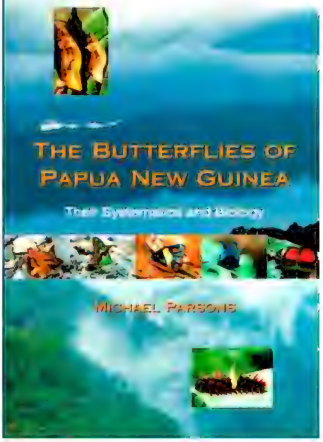


Figure 3. Cover of Parsons' *Butterflies of Papua New Guinea* (1999)

Photos Roger Kitching

ALFRED RUSSEL WALLACE AND THE BIRDWING OF BATCHIAN

Roger Kitching, Peter Hendry

Wallace spent six months on the island of Batchian in the Moluccas just west of New Guinea in 1858/59. He devotes a whole chapter to this period in his travelogue *The Malay Archipelago* (5th edn, 1874). The island (now referred to as Batjan or Bacan) was notable for its rich butterfly fauna and it was here that Wallace had his famous encounter with the Golden Birdwing which he later named. He wrote:

> *The beauty and brilliance of this insect are indescribable and none but a naturalist can understand the intense excitement I experienced when I, at length, captured it. On taking it out of my net and opening the glorious wings, my heart began to beat violently, the blood rushed to my head, and I felt much more like feinting than I have done when in apprehension of immediate death.*

Wallace's specimen still exists (see Figure), now housed in the Natural History Museum, London.

Wallace's Golden Birdwing (*Ornithoptera croesus*) is now considered to exist as two subspecies, the nominate form *croesus* from Batchian, and a second, *lydia.* from the larger adjacent island of Halmahera. Like many of the *Ornithoptera* (including the Australian, *richmondia, euphorion* & *priamus*) the taxonomic standing of this species was long debated. For a time it was thought of by many as merely a golden variant of the green and black *priamus*. Once genitalia were compared, however, (rather the rather variable wing patterns) it was reinstated by Zeuner (1943) as a full species. This status was confirmed and maintained in the definitive work of Haugum and Low (1979).

REFERENCES

Haugum, J. and Low, A. M. (1979). *A Monograph of the Birdwing Butterflies,* Volume 1, Part 2 *Ornithoptera (Ornithoptera).* Scandinavian Science Press, Klampenborg.

Wallace, A. R. (1874). *The Malay Archipelago,* 5th Edition), Macmillan & Co., London.

Zeuner, F. E. (1943). Studies in the systematics of *Troides* Hübner and its allies. Distribution and in relation to the geological history of the Australian archipelago. *Transactions of the Zoological Society of London* **15**, 107-184.

Photo Peter Hendry

Life history notes on the Scarlet Jezebel, *Delias argenthona* (Fabricius, 1793) Lepidoptera: Pieridae – *Wesley Jenkinson*

This beautifully coloured, well-known butterfly is currently recognised from two subspecies within the Australian mainland. *Delias argenthona argenthona* occurs in Queensland and New South Wales, with records also known from the Australian Capital Territory and northern central Victoria. Adults occur along the eastern coastal and subcoastal areas, the Great Dividing Range and penetrate well inland into the drier regions.

A second subspecies, *Delias a. fragalactea* (Butler, 1869) occurs in the northern areas of the Northern Territory and Western Australia. This subspecies was included in the earlier publications of Common and Waterhouse although not supported in Braby 2000 or 2004, due to the adult wing pattern falling within the known seasonal form pattern variation of the nominate subspecies. However, it is currently included in Braby 2016 who revised its status in 2010. Further discussion on these subspecies will be covered in Peter Hendry's series on *Delias*, beginning in this issue.

The mapped range in Braby 2000 has been increased in Braby 2016 for adjacent areas towards western Queensland and western New South Wales. This is probably a result of more recent reporting of observations, rather than the butterfly expanding its range.

The adults occur in a wide variety of habitats where their mistletoe host plants are established. They occasionally occur in tropical, subtropical and temperate rainforest, as well as dry vine scrub and paperbark (or melaleuca) forest; although they are more frequently found in eucalypt open forest and woodland. They can also be seen commonly in suburban parks and gardens if the host plants are established nearby and suitable nectar is available.

Adults fly high above the ground around tree tops where the host parasitic mistletoes grow but fly much lower when in search of nectar. Males often visit hilltops from late morning into the late afternoon. Hilltopping behaviour and flight is not as strong in comparison with the Spotted Jezebel (*D. aganippe*) which can occur on the same hilltops. Adults settle on the tops of larger leaves when resting and feed on a range of native and exotic flowers, being particularly partial to Callistemon,

Melaleuca, Grevillea and Lantana. Whilst feeding the wings generally remain closed. Flight can occur in various weather conditions including full sun, cloud and occasionally light drizzle during warm weather. I have also observed an adult flying in a rather cold, sunny temperature of 14 degrees Celsius at 8.00 am in June at Beaudesert in south-east Queensland.

D. aganippe Male underside *D. mysis* Male underside

Adults in flight could be confused with similar sized pierids, including the Spotted Jezebel *D. aganippe* and the Red-banded Jezebel *D. mysis* in areas north of Rockhampton. Careful observation should place this species.

Individual specimens show variation in size and colour pattern, having two seasonal forms: one being a 'pale form' which is the summer (or wet) season form and the second being a 'dark form' which is the winter (or dry) season form. Intermediate forms also occur. As pictured, the adults of the winter form have broader black margins on the upperside and the underside of the wings and the yellow coloration on the underside is generally darker with additional suffused black scaling present. Overall average size between the two forms is similar.

The sexes as pictured below show males and females being rather similar in appearance. However, the female has a more rounded forewing and the black costal, apical and terminal markings are broader.

Wingspans for the typical summer form adults pictured are males 60mm and females 65mm respectively. Wingspans for the typical winter form adults pictured are males 56mm and females 63mm respectively.

Delias argenthona argenthona **(Scarlet Jezebel – Typical 'Summer' Form)**
Images left to right: male upperside, female upperside

Delias argenthona argenthona **(Scarlet Jezebel – Typical 'Summer' Form)**
Images left to right: male underside, female underside

Delias argenthona argenthona **(Scarlet Jezebel – Typical 'Winter' Form)**
Images top left to right: male upperside, female upperside
Images lower left to right: male underside, female underside

This butterfly utilises a number of host plants in the Loranthaceae (mistletoe) family and one in the Santalaceae (root parasite) family. In recent years, new mistletoes have been added as host plants. References to various species are given in Braby 2000 (10 species) & 2016 (16 species), Moss and Kendall 2016 (13 species) and Moss 2019 (13 species).

The life history is rather well known and has been documented by various authors in Common & Waterhouse (1972 & 1981), Braby (2000) etc. Images of the life history are also shown in Moss and Kendall 2016.

Although I haven't witnessed ovipositing taking place, the eggs are laid in tight clusters of varying numbers averaging 35 (Braby 2000). The eggs are laid on either leaves or stems of the host plant. As described in Braby 2000, "when all of the eggs of a given cluster have hatched, the newly emerged larvae proceed to devour the eggshells"

The eggs are pale yellow (or orange-yellow), being approximately 1.2mm high x 0.7mm wide, bottle shaped with approximately 25 fine longitudinal ribs (Braby 2000).

Larvae are gregarious (Braby 2000) and feed openly on the mistletoe during daylight. They rest on the leaves or smaller stems of the host plant on a spun silk web. While feeding they chew pieces from the outside edge of the host leaf. Although I haven't studied this species thoroughly, raised larvae were thought to complete 5 instars as pictured with a final instar reaching 42mm in length.

1st instar larvae

2nd instar larvae

3rd instar larvae ↑
4th instar larvae →

5th instar larva

Pupae measuring between 24-26mm were attached by a silk central girdle and the cremaster to a silken pad on host leaves. When disturbed the pupae wriggled their abdomens vigorously, laterally from side to side. Pupae may occasionally be found several metres away from the host plant on vegetation near the base of the tree hosting the mistletoe. Pupal duration during March 2008 at Beaudesert was 10 days.

The lifecycle from Mitchell in Queensland during May (E.O. Edwards 1948) was; egg duration 6 days, larvae pupated in August with adults emerging in September (in Braby 2000).

Within the new boundary of the Scenic Rim Regional Shire south of Brisbane, I have adult records for all months of the year. In this location the adults are most numerous during the autumn months and still may be common in other months in certain years. It is possible there may be three or four generations per year in this region. The adults can persist during rather dry periods as long as the host mistletoes and nectar are available.

I would like to thank John Moss for additional suggestions to the manuscript.

References:

Braby, M.F., 2000. *Butterflies of Australia – Their Identification, Biology and Distribution.* vol **1**. CSIRO Publishing, Melbourne.

Braby, M.F., 2016. *The complete field guide to Butterflies of Australia* – Second edition. CSIRO Publishing, Melbourne.

Common, I.F.B. and Waterhouse D.F., 1972 & 1981. *Butterflies of Australia.* Angus & Robertson Publishers.

Moss, J.T and Kendall, R, 2016. *The Mistletoes of Subtropical Queensland, New South Wales and Victoria*. Butterfly & Other Invertebrates Club Inc.

Moss, J.T., 2019. *Butterfly Host Plants of South-east Queensland and northern New South Wales*. 4th (rev) ed. Butterfly & Other Invertebrates Club.

****

Dr Geoff Monteith Listed in the Top Ten Scientist List – Congratulations –

Lenora Dawn Franzmann

Charles Darwin visited our shores in March 1836 in "The Beagle" and in 1960 Geoff Monteith commenced his studies at the University of Queensland. Geoff realised a couple of years into his science course, Entomology was to be his specialty.

Geoff Monteith has been listed at Number 10 on the list of the scientists who have had insects and other animals and plants named after them. Charles Darwin is Number 1. Geoff has had 235 species and 16 genera named after him and has collected over 200,000 insects. The list was compiled by Stephen Heard, a biologist at

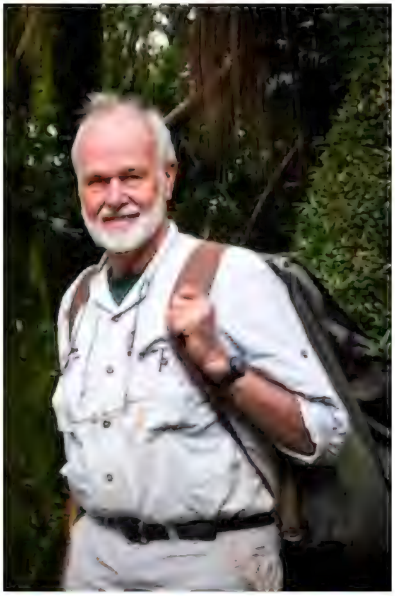
the University of New Brunswick (Canada) in his book, *Charles Darwin's Barnacle and David Bowie's Spider: How Scientific Names Celebrate Adventurers, Heroes, and Even a Few Scoundrels.*

Top 10 worldwide scientists with the greatest number of named species in their honour:

- Charles Darwin, Geologist, England
- Alfred Russel Wallace, Biologist, England
- Joseph Dalton Hooker Botanist, England
- William Jackson Hooker, Botanist, England
- Alexander von Humboldt, Polymath, Germany
- Augusto Weberbauer, Botanist, Germany
- Julian Steyermark, Botanist, USA
- Cyrus Guernsey Pringle, Botanist, USA
- Willy Kuschel, Entomologist, New Zealand
- Geoffrey Monteith, Entomologist, Queensland, Australia, Queensland Museum

He was in attendance at the inaugural meeting of BOIC and became a founding member in December 1994. The help and advice he has given over many years has been greatly appreciated.

Geoff was recently interviewed by ABC radio during which he shared some memories of his entomological journey. He commented to the Presenter that he was "a little chuffed to hear this news".



Upon reaching his teens he moved to Brisbane with his family after spending his younger years on a dairy farm in the South Burnett - eventually leading him to his studies at the University of Queensland.

During this time the Head of Entomology, the famous Frederick Athol Perkins, was approached by the Bishop Museum, Hawaii, seeking a student to help collect insects for three months at their field station at Wau in the New Guinea highlands. Geoff was offered this opportunity which he readily accepted.

I believe that, during his career, he has led backpacking parties on foot to summits of forty-nine mountains between Cooktown and Townsville, collecting and leaving traps. With no GPS or mobile phone and certainly no Workplace, Health and Safety Standards to

adhere to in those days, they returned to make the sometimes-difficult climbs to collect the specimens from the traps and carry down bags of leaf litter for processing.

I have heard stories about Geoff's expertise from my husband, Bernie Franzmann, who commenced his studies in 1963. Other members of BOIC have experienced Geoff's willingness to help and provide specimens and a few of these people have offered their recollections and thoughts. As you will read, a similar pattern flows and admiration for Geoff's expansive knowledge and willingness to share is evident.

One particular story, which I have heard many times, goes something like this: Bernie first met up with Geoff when they were both doing Botany 1, at night, at the University of Queensland in 1963. After this stint, they went their different ways and they met up again when Geoff was a demonstrator in the Entomology 3, Practical Class. Part of the process was to place insect specimens into Families by the use of keys.

One weekend, Bernie collected a very small nondescript beetle, about the size of a pin head, eating a shelf fungus. He commenced the process of putting it through the beetle key during a session in the laboratory. He got to the end of the key and it hadn't fitted into any Family. Putting his hand up for help, Geoff came along to have a look at it. He conveyed to Geoff his dilemma.

Geoff had a cursory look and asked "OK, did you find it on a shelf fungus?" Now, remember he had not mentioned where he had found it. Bernie replied with a look of amazement "yes". Geoff instantly informed him of its name (Genus and species) and it most certainly did not fit into the key. This was no common or garden beetle, it seemed to have no distinguishing marks etc. However, Geoff didn't pause, he knew!!

Bernie was suitably impressed and this memory is etched into his mind and he has always maintained ever since, that Geoff Monteith knows more about Australian insects than most other people.

Richard Zietek also shares a memory of Geoff from his University studies circa 1968/1969. He was studying Zoology and he ended up at the University Collection one day. Geoff held the position of the Curator of Insects. At that time there were not many books on beetles and Richard had become a keen collector. He made many a trip to the Collection to seek the advice of Geoff and obtain an identification. As was the case, and still is, Geoff could identify the beetle for Richard. Richard had an interest in a beetle, a member of the Rutelinae (Christmas beetle) subfamily, named, *Anoplognathus multiseriatus*, that Geoff and David Hancock had collected in Tin Can Bay in 1970. Richard left that day with a specimen and it remains in his collection.

Ross Kendall has met with Geoff many times over the years and has always enjoyed a relaxed talk with him - he is never too busy to have a talk and share information with Ross. After, perhaps, talking about the insect/issue at hand, they soon lapse into anecdotes about adventures in the past. Ross feels that Geoff's anecdotes would fill a book with interesting and entertaining yarns. One recent one about how he, on his

own, encountered two duelling red deer stags on Mount Oakview near Kilkivan is worth rehearing!

We are privileged and honoured to have Dr Geoff Monteith as a member of the Butterfly & Other Invertebrates Club Inc.

Still collecting, still interested, still discovering, just being Geoff Monteith. Congratulations, a well-deserved honour.

References:
Media Release and Blog, Christine Robertson, Queensland Museum
ABC Radio interview
Bernie Franzmann, Richard Zietek and Ross Kendall
Photo contributed by Geoff Monteith

****

The genus *Charaxes* (Lepidoptera: Nymphalidae) a look at the Australian species from an historical perspective and an overall view of the world taxa – continued from Metamorphosis Australia Issue No. 98 – Final –

Peter Hendry

Candiope group contains 5 species

Fig. 112♂

Fig. 113♀

Charaxes candiope (Godart, 1824) (Figs 112 & 113). The location of the type species was noted as unknown in the original description. The species is known from Botswana, Cameroon, Ethiopia, Gambia, Ghana, Guinea, Ivory Coast, Kenya, Mozambique, Namibia, Nigeria, Senegal, Sierra Leone, South Africa, Swaziland, Tanzania, Zambia and Zimbabwe. The larvae feed on species of *Croton* (Euphorbiaceae).

Charaxes antamboulou Lucas, 1872 (Figs 114 & 115). The type species is from Madagascar to which it is endemic. The larvae feed on species of *Croton* (Euphorbiaceae).

Fig. 114♂

Fig. 115♂v

The other species in the Candiope group are, *Charaxes thomasius* Staudinger, 1886, *Charaxes velox* Ogilvie-Grant, 1899 and *Charaxes cowani* Butler, 1878.

Elwesi group contains 1 species.

Charaxes elwesi elwesi Joicey & Talbot, 1922 was described from a single worn female from the Indonesian island Sumbawa to which it is endemic. I found nothing on its larval food plants. There is one other subspecies involved, *C. e. pugnax* Tsukada & Nishiyama, 1979 which is endemic to the Indonesian island of Sumba being southeast of Sumbawa.

Mars group contains 4 species.

Charaxes mars mars Staudinger, 1886. The type, a male, was taken by Dr. Platen in Minahassa, N. Celebes (now north Sulawesi) Indonesia and is endemic to the area. The first female was not caught until the 8th of June 1947, by a Mr. A. W. van Laer. I found nothing of the larval food plants. There is one other subspecies involved,

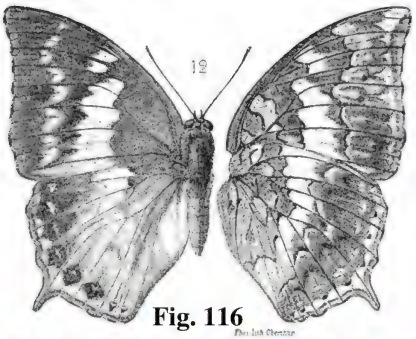


Fig. 116

Fig. 117

C. m. dohertyi Rothschild, 1892 (illustrated but unavailable) from south Sulawesi. Charles Oberthur illustrated this subspecies (Fig. 116) in his article, Descriptions of New Lepidoptera, in the Bulletin de la Société Entomologique de France, 1897.

The other species in the Mars group are, *Charaxes marki* Lane & Müller, 2006 from East Timor, *Charaxes ocellatus* Fruhstorfer, 1896 from the Lesser Sunda Islands and ***Charaxes orilus*** Butler, 1869 from Timor, illustrated (Fig. 117) along with the original description.

Nitebis group contains 1 species

Charaxes nitebis nitebis Hewitson, 1862 was illustrated (Fig. 118) along with the original description. The type location was given as Celebes (now Sulawesi). I found nothing on the larval food plants. There are two other subspecies involved, *Charaxes nitebis luscius* Fruhstorfer, 1914 from Sulawesi and *Charaxes nitebis sulaensis* Rothschild, 1900 from the Sula Islands, Indonesia.

Fig. 118♂

Harmodius group contains 2 species.

Charaxes distanti distanti Honrath, 1885 (Figs 119 & 120). The type location is Perak, Malay Peninsula. It is also found in south Myanmar and Thailand. I found nothing on its larval food plants. There are two other subspecies involved, both of which were described by Fruhstorfer, 1914

Fig. 119

Fig. 120

in Seitz's, *Die Gross-Schmetterlinge der Erde* 9; *C. d. phlegmone* Fruhstorfer, 1914 based upon West Sumatran specimens and *C. d. thespius* Fruhstorfer, 1914 founded on specimens from S. E. Borneo.

The other species in the Harmodius group is, *Charaxes harmodius harmodius* Felder & Felder, 1867 with a total of five subspecies.

Amycus group contains 3 species

Charaxes amycus amycus Felder & Felder, 1861. The type location was given as the Philippines, to which it is endemic. It was illustrated (Fig. 121) by Butler, 1872 under the synonym ?*Charaxes lunawara* in Lepidoptera Exoticia. I found nothing on the larval food plants. There are another six subspecies involved; *C. a. georgius* Staudinger, 1892 from Mindoro, Philippines; *C. a. myron* Fruhstorfer, 1914 from Polillo and Guimaras, Philippines; *C. a. carolus* Rothschild & Jordan, 1900 from Mindanao and Camiguin de Mindanao, Philippines; *C. a. bayani* Schröder & Treadaway, 1982 from Marinduque, Philippines; *C. a. theobaldo* Schröder & Treadaway, 1982 from Panay, Philippines and *C. a. marion* Schröder & Treadaway, 1981 from Sibuyan and Romblon, Philippines; with a further possible subspecies *C. a. negrosensis* Schröder & Treadaway, 1982 from Negros, Philippines, not in Wahlberg's checklist.

Fig. 121

The other species in the Amycus group are, *Charaxes antonius* Semper, 1878 and *Charaxes sangana* Schroder & Treadaway, 1988.

Eurialus group contains 2 species

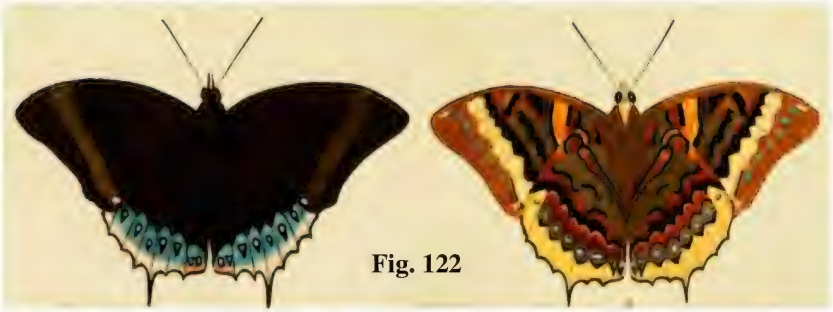


Fig. 122

Fig. 123

Charaxes eurialus (Cramer, 1779) was illustrated (Fig. 122) along with the original description. The type location was given as Amboina. It is found on Ambon Island, Serang and Saparua in Indonesia. I found nothing on its larval food plants. The other species in the Eurialus group is, *Charaxes madensis* Rothschild, 1899. Though described in The Entomologist, 1899 it was illustrated (Fig. 123) in Novitates zoologicae, 1899.

Latona group contains 4 species. This group has been partly dealt with in the Australian section of this article.

Apart from *Charaxes latona latona* Butler, 1865 the other species in the Latona group are, *Charaxes affinis* Butler, 1865, *Charaxes musashi* Tsukada, 1991 and *Charaxes setan* Detani, 1983.

Bernardus group contains 12 species.

Charaxes bernardus bernardus (Fabricius, 1793). The female was illustrated

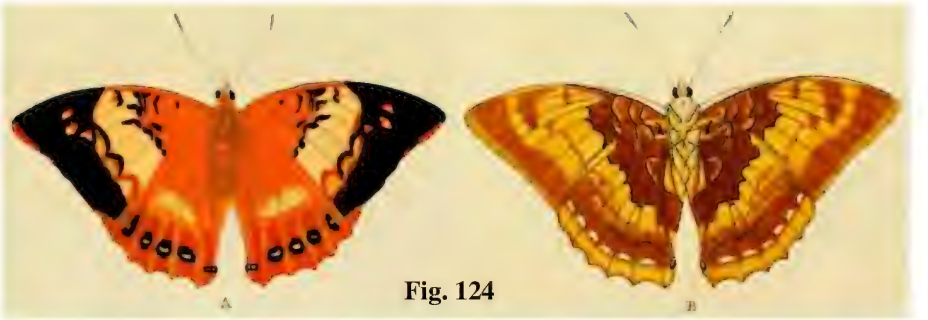


Fig. 124

(Fig.124) by Cramer, [1775] under the synonym *Papilio polyxena* in *De uitlandsche kapellen, voorkomende in de drie waereld-deelen Asia, Africa en America* Vol. 1. The type location was given by Fabricius as China. Rothschild, 1900 in Novitates Zoologicae Vol 7, under the synonym *Charaxes polyxena*, notes its distribution as "*from N.W. India to China, Palawan and Java*". Larvae feed on *Cinnamomum camphora, Cinnamomum inunctum*, *Phoebe chekiangensis* (Lauraceae); *Acronychia pedunculata* (Rutaceae); *Adenanthera pavonina*, *Albizia falcata* and *Tamarindus indica* (Fabaceae). There are at least another sixteen subspecies involved; *C. b. hierax* Felder & Felder, [1867] from Assam in India and southern Yunnan in China; *C. b. agna* Moore, 1878 from Thailand and Myanmar; *C. b. hemana* Butler, 1870 from Nepal; *C. b. hindia* Butler, 1872 from Darjeeling in India; ***C. b. crepax*** (Figs 125 & 126) Fruhstorfer, 1914 from Malaysia and Singapore; *C. b. mahawedi* Fruhstorfer, 1914 from Vietnam; *C. b. phlegontis* Fruhstorfer, 1914 from Bangka

Fig. 125

Fig. 126

island, Indonesia; *C. b. ajax* Fawcett, 1897 from Sumatra; *C. b. acolus* Fruhstorfer, 1914 from Sumatra; *C. b. mitschkei* Lathyi, 1913 from Nias Island, Indonesia; *C. b. enganicus* Fruhstorfer, 1904 from Enggano Island, Indonesia; *C. b. basilisae* Schröder & Treadaway, 1982 from the Philippines; *C. b. varenius* Fruhstorfer, 1906 from Java; *C. b. baya* Moore, 1857 from Java; *C. b. cybistia* Fruhstorfer, 1914 from Natuna Island, Indonesia and *C. b. hainanus* Gu, 1994 from China. Another possible subspecies is *C. b. baliensis* Joicey & Talbot, 1922 from Bali. It was described as *Charaxes polyxena baliensis* in the Bulletin of the Hills Museum Vol 1. Many of the above subspecies were also named under *Charaxes polyxena* which has since been synonymized with *Charaxes bernardus*. There are four other subspecies authored by Hanafusa, 1990-1992 published in the journal *Futao* which are not in Wahlberg's checklists.

Charaxes borneensis borneensis Butler, 1869 was illustrated (Fig. 127) along with

Fig. 127

Fig. 128

the original description. Figure 128, from the Pickering collection, best fits this subspecies. The type location was given as Sarawak ♂, Borneo ♀. It also occurs in Sumatra and the Malay Peninsula. I could find nothing on the larval food plants. There are three other subspecies involved; *C. b. daemoniacus* Fruhstorfer, 1914 from Sumatra; ***C. b. praestantius*** Fruhstorfer, 1914 (Figs 129 & 130) from Thailand, Malaya and Singapore and *C. b. vandepolli* Lathy, 1913 from Nias Island, Indonesia.

Fig. 129

Fig. 130

Charaxes durnfordi durnfordi Distant, 1884 (Fig. 131). The type location was given as "Sunjei Ujong, Malay Peninsula". It appears to be endemic to the Malay Peninsula. I found nothing on the larval food plants. There are four other subspecies involved; *C. d. nicholi* (Grose-Smith, 1886) from Myanmar; *C. d. connectens* de Nicéville, 1897 from Sumatra; *C. d. staudingeri* Rothschild, 1894 from Java and *C. d. everetti* Rothschild, 1894 from Borneo. Another possible subspecies, not in Wahlberg's checklist, is *Charaxes durnfordi merguia* Tytler,1926 [J. Bombay nat. Hist. Soc. 31(3):579, pl.5, fig.2.♂] from Myanmar and Thailand.

Fig. 131

Tiridates group contains 18 species

Charaxes tiridates tiridates (Cramer, 1777) (Figs 132 & 133), is a sexually dimorphic

Fig. 132♂

Fig. 133♀

Fig. 134♂

Species. The male was illustrated (Fig. 134) along with the original description. A common theme amongst Cramer's description is his misplaced type locations. He stated that this species is from "*the islands of Java & Ambon*" but it is known only from the African countries of Benin, Burkina Faso, Ghana, Guinea, Ivory Coast, Liberia, Nigeria, Senegal, Sierra Leone, and Togo. The larvae feed on species of *Phialodiscus*, *Blighia* (Sapindaceae); *Hugonia* (Linaceae); *Bombax* (Bombacaceae); *Chaetacme* (Ulmaceae); *Celtis* and *Trema* (Cannabaceae); *Grewia*

(Tiliaceae); *Hibiscus* (Malvaceae); *Flacourtia* (Salicaceae); *Osyris* (Santalaceae); *Afzelia*, *Albizia*, *Indigofera*, *Berlinia*, *Lonchocarpus*, *Cassia*, *Dalbergia*, *Macrolobium*, *Millettia* and *Pterocarpus* (Fabaceae). There are three other subspecies involved; *C. t. choveti* Turlin, 1998 from Equatorial Guinea; *C. t. marginatus* Rothschild & Jordan, 1903 from Ethiopia and ***C. t. tiridatinus*** Röber, 1936 [(Figs 135 & 136) in the Pickering collection simply as *Charaxes tiridates* best fit this subspecies] from Angola, Burundi, Cameroon, Central African Republic, Congo, Democratic Republic of the Congo, Gabon, Kenya, Nigeria, Rwanda, Sudan, Tanzania, Uganda and Zambia.

Fig. 135

Fig. 136

Charaxes ameliae ameliae Doumet, 1861 (Figs 137 & 138) is another sexually

Fig. 137♂

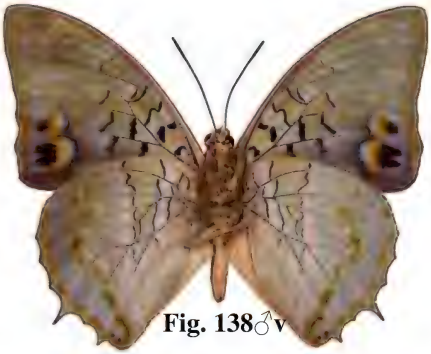


Fig. 138♂v

dimorphic species. The type species is from Gabon (Gabonese Republic) it also occurs in Cameroon, Central African Republic, Congo, Democratic Republic of Congo and Nigeria. The larvae feed on *Brachystegia spiciformis*, *Julbernardia globiflora*, *Albizia adianthifolia* and *Baikiaea insignis* (Fabaceae). There are three other subspecies involved; *C. a. amelina* Joicey & Talbot, 1925 from Democratic Republic of Congo, Malawi, Tanzania and Zambia; *C. a. doumeti* Henning, 1989 from Ghana, Guinea, Ivory Coast, Liberia, Nigeria, Sierra Leone and Togo, and ***C. a. victoriae*** van Someren, 1972 (Figs 139 &140) from Kenya, Tanzania and Uganda.

Fig. 139♂

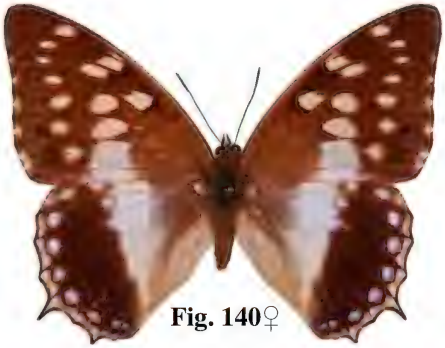


Fig. 140♀

Charaxes bipunctatus bipunctatus Rothschild, 1894 (Fig. 141) a sexually dimorphic species the female being similar to *Charaxes tiridates* (Fig. 133). One notable difference is the short tails on *C. bipunctatus*, on both male and female. Rothschild noted the type as being from "West Africa, probably Gold Coast", it also occurs in Ghana, Ivory Coast and Nigeria. The larvae feed on *Blighia unijugata* (Sapindaceae). There is one other subspecies involved, ***C. b. ugandensis*** van Someren, 1972 (Figs 142 & 143) from Cameroon, Central African Republic, Congo, Democratic Republic of Congo, Gabon, Kenya, South Sudan, Sudan, Tanzania and Uganda.

Fig. 141♂

Fig. 142♂

Fig. 143♂v

Charaxes mixtus mixtus Rothschild, 1894 (Figs 144 & 145). The type species is

Fig. 144♂

Fig. 145♂v

from Lukolele, N. Congo. It also occurs in Cameroon, Central African Republic, Democratic Republic of Congo and Gabon. I could find nothing on larval food plants. There is one other subspecies involved; *C. m. tanzanicus* Kielland, 1988 from Tanzania.

Charaxes numenes numenes (Hewitson, 1859) along with the original description

Fig. 146

Fig. 147♂

Fig. 148

William Hewitson illustrated the male underside (Verso) and the upper-sides (Recto) of both the male and female of this sexually dimorphic species (Fig. 146). Figure 147 is a ♂ specimen from the Guyomar collection. Schultze, 1916 illustrated the larva (Fig. 148). Described under the genus *Nymphalis,* Hewitson noted "*This species is, in both sexes, exactly similar to* N. Tiridates *on the upper side; below it is abundantly distinct*". The type species is from Sierra Leone and it also occurs in Benin, Ghana, Guinea, Guinea-Bissau, Ivory Coast, Liberia, Nigeria and Senegal. The larvae feed on species of *Hugonia* (Linaceae), *Grewia* (Tiliaceae), *Erythrina* (Fabaceae), *Allophylus*, *Deinbollia*, *Blighia* and *Phialodiscus* (Sapindaceae). There are three other subspecies involved; *C. n. aequatorialis* van Someren, 1972 from Angola, Cameroon, Central African Republic, Congo, Democratic Republic of the Congo, Gabon, Kenya, Nigeria, South Sudan, Sudan, Tanzania, Uganda and Zambia; *C. n. malabo* Turlin, 1998 from Equatorial Guinea and *C. n. neumanni* Rothschild, 1902 from Ethiopia.

Charaxes smaragdalis smaragdalis Butler, 1866 (Figs 149 &150). The type species

Fig. 149♂

Fig. 150♂v

is from Congo. It is also found in Cameroon, Central African Republic, Democratic Republic of Congo, Gabon and Nigeria. I could find nothing on the larval food plants for this species. There are eleven other subspecies involved; *C. s. allardi* Bouyer & Vingerhoedt, 1997 from Democratic Republic of Congo; *C. s. butleri* Rothschild, 1900 from Ghana, Guinea, Ivory Coast, Liberia and Sierra Leone; *C. s. caerulea* Jackson, 1951 from Democratic Republic of Congo and Uganda; *C. s. elgonae* van Someren, 1964 from Kenya and Uganda; *C. s. gobyae* Plantrou, 1989 from South Sudan and Sudan; *C. s. homonymus* Bryk, 1939 from Tanzania; *C. s. kagera* van Someren, 1964 from Tanzania; *C. s. kigoma* van Someren, 1964 from Tanzania; *C. s. leopoldi* Ghesquiere, 1933 from Angola, Congo and Democratic Republic of Congo; *C. s. metu* van Someren, 1964 from Uganda and *C. s. toro* van Someren, 1964 from Uganda.

Charaxes imperialis imperialis Butler, 1874 (Fig. 151). The type species was collected at Whydah, on the Gold Coast, Africa. It has also been recorded from Benin, Ghana, Guinea, Guinea-Bissau, Ivory Coast, Liberia and Sierra Leone. The larvae probably feed on species of Sapindaceae. There are eight other subspecies involved; ***C. i. albipuncta*** Joicey & Talbot, 1920 (Figs 152 & 153), [while not convinced it is this subspecies, I could not place these specimens in any other and have left it as per the Guyomar collection] it is found in Cameroon,

Fig. 151♂

Fig. 152♂

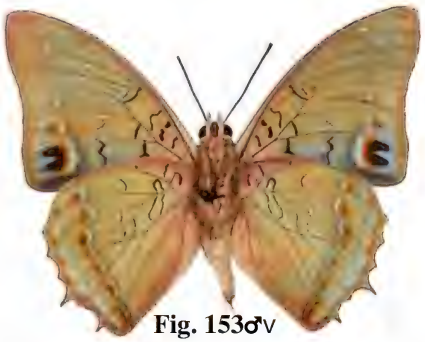


Fig. 153♂v

Central African Republic, Democratic Republic of the Congo and Nigeria; *C. i. dargei* Collins, 1989 from Congo; *C. i. graziellae* Turlin, 1989 from Tanzania; *C. i. lisomboensis* van Someren, 1975 from Tanzania and Zambia; *C. i. nathaliae* Canu, 1989 from Equatorial Guinea; *C. i. pauliani* Rousseau-Decelle, 1933 from the Democratic Republic of Congo; C. *i. ugandicus* van Someren, 1972 from the Democratic Republic of Congo and Uganda and, *C. i. werneri* Turlin, 1989 from Rwanda.

The other species in the Tiridates group are, *Charaxes barnsi* Joicey & Talbot, 1927, *Charaxes bohemani* Felder & Felder, 1859, *Charaxes cithaeron* Felder & Felder, 1859, *Charaxes fuscus* Plantrou, 1967, *Charaxes montieri* Staudinger, 1886, *Charaxes murphyi* Collins, 1989, *Charaxes nandina* Rothschild & Jordan, 1901, *Charaxes overlaeti* Schouteden, 1934, *Charaxes pythodoris* Hewitson, 1873, *Charaxes violetta* Grose-Smith, 1885 and *Charaxes xiphares* (Stoll, 1781).

Nobilis group contains 3 species

Charaxes nobilis nobilis Druce, 1873 (Figs 154 & 155). The type location was given

Fig. 154♂

Fig. 155♂v

as "Old Calabar", Nigeria. It is also found in Cameroon, Gabon, Congo, Central African Republic, Democratic Republic of Congo and Uganda. I found nothing on the larval food plants. There are two other subspecies involved; *C. n. claudei* Le Moult, 1933 from Guinea, Ivory Coast, Ghana and Nigeria and *C. n. rosemariae* Rousseau-Decelle, 1934 from the Democratic Republic of Congo.

The other species in the Nobilis group are, *Charaxes superbus* Schultze, 1909 and *Charaxes lydiae* Holland, 1917

Acraeoides group the last of the species groups, contains 14 species

Charaxes acraeoides Druce, 1908 was illustrated (Fig. 156) by Schultze, 1916. The type species came from Cameroon. It is also found in Gabon, the Republic of Congo, the Central African Republic and the Democratic Republic of Congo. I found nothing on the larval food plants.

Fig. 156

The other species in the Acraeoides group are, *Charaxes amandae* Rydon, 1989, *Charaxes carteri* Butler, 1881, *Charaxes dubiosus* Röber, 1936, *Charaxes fournierae* Le Moult, 1930, *Charaxes galleyanus* Darge & Minig, 1984, *Charaxes gerdae* Rydon, 1989, *Charaxes jolybouyeri* Vingerhoedt, 1998, *Charaxes phenix* Turlin & Lequeux, 1993, *Charaxes prettejohni* Collins, 1990, *Charaxes teissieri* Darge & Minig, 1984, *Charaxes viossati* Canu, 1991, *Charaxes virescens* Bouyer, 1991 and *Charaxes zambeziensis* Henning & Henning, 1994.

In preparing this article I am indebted to the following; Jak Guyomar for access to his vast collection and to his wife Virginia who sustained me with coffee and a scrumptious meal during my hours of photography; to John Moss for access to his collection of Malay species; to the late Jim Pickering whose collection is in my care and the Biodiversity Heritage Library for access to the original manuscripts and the original illustrations used throughout this article. All photos are by me except Fig. 94 (*Charaxes jasius*) by Charles J Sharp (https://en.wikipedia.org/wiki/Charaxes_jasius).

Notes:

1: Phenetic, similar looking

2: Nomen nudum, a name first published without a description. Often brought about by the use of manuscript names and are unavailable until associated with a description or illustration

3: Junior subjective synonym, junior, the more recent; subjective, having a different type; synonym, the same species has been described before

4: Apomorphic, a novel evolutionary trait that is unique to a particular species

5: Cladogram, a branching treelike diagram used to illustrate evolutionary relationships between a number of species

6: Synapomorphic, a derived taxonomic character shared by two or more taxa forming an inclusive group

7: Seba's "Thesaurus", best known under the Latin title *Locupletissimi rerum naturalium thesauri accurata descriptio, et iconibus artificiosissimis expressio per universam physices historiam*, was also published under a Dutch and French title. Volume 4 was published in 1765, twenty-nine years after Albertus Seba's death. It was edited by Arnout Vosmaer who was assisted by several naturalists. As Linnaeus's first edition of Systema Naturae, which only dealt with plants, was printed in 1735 the year before Seba's death, I believe any reference to Linnaeus was added by the editor. Seba's Cabinet of Natural Curiosities contained all sorts of things including shells, lizards, snakes, birds, and insects which became the contents of his "Thesaurus" which also included mythical beasts such as the hydra.

References:

Though I have listed the authors of all species and the date of authorship, I have not listed all the references of the original descriptions. Most of these are readily available at:
(https://ftp.funet.fi/pub/sci/bio/life/insecta/lepidoptera/ditrysia/papilionoidea/nymphalidae/charaxinae/charaxes/)

Aduse-Poku, K., Vingerhoedt, E. & Wahlberg N., 2009; Out-of-Africa again: A phylogenetic hypothesis of the genus Charaxes (Lepidoptera: Nymphalidae) based on five gene regions. *Molecular Phylogenetics and Evolution* Volume 53, Issue 2, November 2009, Pages 463-478

Atkins, A., 1975; Notes on hill-topping butterflies of Queensland. *Victorian Entomologist*, p132

Barrett, C. & Burns, A.N., 1951; *Butterflies of Australia and New Guinea*, p139. Morris & Walker Pty Ltd Melbourne.
Beutenmüller, W., 1901; Australian Lepidoptera. *Journal of the New York Entomological Society*, p151.
Billberg, G. J., 1820; *Enumeratio insectorum in Museo*, p79 & 80.
Braby, M.F., 1987; *Polyura Pyrrhus Sempronius at Christmas Hills. Victorian Entomologist* Vol 17 p39.
Braby, M. F., 2000; *Butterflies of Australia, Their Identification, Biology and Distribution*, CSIRO Publishing.
Braby, M. F., 2003; *The Complete Field Guide to Australian Butterflies*, p174. CSIRO Publishing.
Braby, M.F., 2010; The merging of taxonomy and conservation biology: a synthesis of Australian butterfly systematics (Lepidoptera: Hesperioidea and Papilionoidea) for the 21st Century. Zootaxa 2707: 1-76 [Date published 3 Dec 2010] [64].
Braby, Michael with Olsen, Penny, 2011; A Flutter of Butterflies, p50 &68. National Library of Australia, Canberra.
Braby, M.F., 2016; *The Complete Field Guide to Australian Butterflies*, second edition, p204. CSIRO Publishing.
Brunet, B. L., 1977; Observations of the Tailed Emperor *Polyura pyrrhus sempronius* (Lepidoptera: Nymphalidae) in South Australia. *Australian Entomologist Mag*. 4 p47.
Butler, A. G., 1866; The Species of Charaxes. *Proceedings of the Scientific Meeting of the Zoological Society of London,* 1865, p633. Longmans, Green, Reader, and Dyer, Paternoster Row, London.
Butler, A. G., 1896; Butterflies of the Genus Charaxes. *The Journal of the Linnean Society of London* Vol. 25 1894-96, p388. Taylor and Francis, Red Lion Court Fleet Street, London.
Common, I.F.B. & Waterhouse D.F., 1972; *Butterflies of Australia*, p277. Angus & Robertson Publications.
Common, I.F.B. & Waterhouse D.F., 1981; *Butterflies of Australia*, p375; revised edition. Angus & Robertson Publications.
Cramer, P., 1777; *De Uitlandsche Kapellenvoorkomende in de Drie Waereld-Deelen Asia, Africa en America* Vol. 2, p34.
D'Abrera, B. L., 1971; *The Butterflies of the Australian Region*. p 244. Melbourne.
D'Abrera, B. L., 1977; *The Butterflies of the Australian Region*. Second edition p244. Melbourne.
Daniels, G. & Moulds, M. S., 1977; The butterflies of Warrumbungle National Park, New South Wales. *Australian Entomologist Mag*. 4, p50.
De Baar, M., 1979; Some new food plants for Australian Lepidoptera with life history notes. Australian Entomologist Mag. 5, p88.
Doubleday, H., 1844; *List of Specimens of Lepidopterous Insects in the Collection of the British Museum* Part I, p110; K. Newman, Printer, 9 Devonshire St. Bishopsgate.
Dunn, K. L. & Aston, C. E., 1985; Some Notes on Butterflies from South-eastern Australia. The Victorian Naturalist, Vol. 103, p120.
Edwards, H., 1889; Notes on Noises made by Lepidoptera. *Insect Life*, p13. Washington:Government Printing Office.

Faithfull, I., 1992; Butterflies at Yarra Bend 1983-90. The Victorian Naturalist Vol. 109, p165.
Felder, C. & Felder, R., 1859; Lepidopterologische Fragmente. Part 4. *Wiener Entomologische Monatschrift* Vo.l 3 p399.
Fisher, R., 1978; *Butterflies of South Australia (Lepidoptera : Hesperioidea, Papilionoidea)*, p165.
Fisher, R., 1995; *A Field Guide to Australian Butterflies*, p152. Surrey Beatty & Sons Pty Ltd, NSW.
Freitas, A.V.L., Brown, K.S.J., 2004. Phylogeny of the Nymphalidae (Lepidoptera: Papilionoidea). *Systematic Biology* Vol. 53, 363–383.
Froggatt, W. W., 1907; *Australian Insects*, p217. William Brooks & Co. Ltd., Sydney.
Godart, J., 1824; *Encyclopédie Méthodique* v9 pt 2 [1819] 1824, p354.
Harslett, J., 1965; Butterflies from the Stanthorpe District, Queensland, with notes on their food plants. *The Queensland Naturalist* Vol. 17, p108.
Hatch, J. H., 1977; A new breeding butterfly Polyura pyrrhus sempronius (Fabricius) in South Australia (Charaxinae). The South Australian Naturalist, Vol. 51, p55.
Hemming, F., 1967 (posthumously). The generic names of the butterflies and their type-species (Lepidoptera: Rhopalocera). Bulletin of the British Museum (Natural History).Volume: Supplement 9, p167. London.
Herrich-Schäffer, G. A. W. [1850] *Systematische Bearbeitung der Schmetterlinge von Europa*.
Hübner, J., 1819; *Verzeichniss bekannter Schmettlinge* [1816], p46
Illidge, R., 1898; List of butterflies of the Brisbane district. *Proceedings of the Royal Society of Queensland*, Vol. 13, p95. H. Polk & Co., 95 Elizabeth Street, Brisbane.
Kirby, W. F., 1871; *A Synonymic Catalogue of Diurnal Lepidoptera*, p271; John Van Voorst, Paternoster Row, London.
Linnaeus, C., 1758; *Systema Naturae. Regnum Animale*, p462.
Linnaeus, C., 1767; *Systema Naturae* (ed. 12) 1 (2); Errata.
Manski, M. J., 1960; Foodplants of some Queensland Lepidoptera. *The Queensland Naturalist* Vol. 16: 68-73 [70].
McCubbin, C., 1971; *Australian Butterflies*, p42. Thomas Nelson, Australia.
Moore, F., 1881; Lepidoptera of Ceylon Vol. 1, p29. L. Reeve & Co, London.
Müller, C. J., Wahlberg, N. and Beheregaray, L. B., 2010; 'After Africa': the evolutionary history and systematics of the genus *Charaxes* Ochsenheimer (Lepidoptera: Nymphalidae) in the Indo-Pacific region; *Biological Journal of the Linnean Society*, 2010, 100, p457–481.
Orr, Albert & Kitching, Roger, 2010; The Butterflies of Australia, p196. Allen & Unwin
Quick, W. N. B., 1974; Some abnormal insect records for the summers of 1972-3, 1973-4. *Victorian Entomologist*, p67 &69.
Rainbow, W. J., 1907; *A Guide to the Study of Australian Butterflies*, p58, 85. T.C. Lothian, 226 Little Collins St. Melbourne.
Rothschild & Jordan, 1898; Monograph of Charaxes and the Allied Prionopterous Genera. Part I. *Novitates Zoologicae* Vol. 5 p593.
Rothschild & Jordan, 1900; Monograph of Charaxes and the Allied Prionopterous Genera. Part III. *Novitates Zoologicae* Vol. 7.
Salmon, Michael A., 2000; *The Aurelian Legacy, British Butterflies and their Collectors*. With

additional material by Peter Marren and Basil Harley; University of California Press; p120-121.

Schultze, A. 1916; Die Charaxiden und Apaturiden der Kolonie Kamerun : Eine Zoogeographische und biologische Studie *Archiv für Biontologie*, Band IV, Heft 1.

Scudder, S. H., 1875; Historical Sketch of the Generic Names proposed for Butterflies: A Contribution to Systematic. *Proceedings of the American Academy of Arts and Sciences* Vol. 10, p166 & 170. John Wilson & Son, Boston.

Smart, P., 1977; A new species of *Polyura* (*Lep: Charaxinae*) from the New Hebrides with some notes on allied species in the Australian region. *Bulletin of the Amateur Entomologists' Society* Vol. 36, p60.

Smiles, Robert L., 1982; The taxonomy and phylogeny of the genus Polyura, Billberg (Lepidoptera : Nymphalidae). Bulletin of the British Museum (Natural History). Entomology series v.44 No 3 pp 115-237.

Stichel, H., 1939; In Bryk, F., *Lepidopterorum Catalogus* pt 93, p596.

Swainson, W. M., 1833; New, Rare, or Interesting Animals, selected chiefly from the Classes of Ornithology, Entomology, and Conchology, and arranged according to their natural affinities. *Zoological Illustrations* Vol. 3, 2nd Series p114. Baldwin & Cradock, Paternoster Row, London.

Talbot, G., 1920; on new Rhopalocera from Central Ceram. The Annals and Magazine of Natural History series 9 Vol. 6, p406.

Toussaint, E. F. A., Morinière, J., Müller, C. J., Kunte, K., Turlin, B., Hausmann, A. and Balke, M., 2015; Comparative molecular species delimitation in the charismatic Nawab butterflies (Nymphalidae, Charaxinae, Polyura). *Molecular Phylogenetics and Evolution* 91 (2015) p194–209.

Toussaint, E. F. A., Morinière, J. and Blake, M., 2016 New Insights into the Systematics of the Genus Polyura Billberg, 1820 (Nymphalidae, Charaxinae) with an Emphasis on the *P. Athamas* Group. *Journal of the Lepidopterists' Society* 70(2), 2016, 145–152

Toussaint, E. F. A., Turlin, B. and Blake, M., 2019 Biogeographical, molecular and morphological evidence unveils cryptic diversity in the Oriental black rajah Charaxes solon (Fabricius, 1793) (Lepidoptera: Nymphalidae: Charaxinae). *Biological Journal of the Linnean Society*, 2019, **126**, 114–130.

Waterhouse, G.A. 1920. Descriptions of new forms of butterflies from the South Pacific. *Proceedings of the Linnean Society of New South Wales* **45**(3): 468-471.

Waterhouse G.A, 1932; *What Butterfly is That?,* p88. Illustrated by Cayley N.W. Angus & Robertson Sydney.

Waterhouse, G. A. & Lylle, G., 1914; *The Butterflies of Australia, A Monograph of the Australian Rhopalocera*, p51. Angus & Robertson, Sydney.

Westwood, John O., [1850]; *The Genera of Diurnal Lepidoptera: Comprising Their Generic Characters, A Notice of their Habits and Transformations, and a Catalogue of the Species of Each Genus*. Vol. 2, 1850-1852, p309; Longman, Brown, Green, and Longmans; London.

Williams, Mark C., 2018; *Afrotropical Butterflies* 17th edition. http://www.lepsocafrica.org/?p=publications&s=atb

The Invertebrate World of Australia's Subtropical Rainforests – Williams. G. (2020) – CSIRO Publishing – Review by *Gary Wilson*

The old adage of 'Don't judge a book by its cover' doesn't apply here, for the cover of Keith Williams' latest offering is clean and eye-catching. It features, on a white background, an image of the Richmond Birdwing butterfly *Ornithoptera richmondia* (Papilionidae), a species that is both visually striking, the centre of sustained conservation efforts, well known to residents, including school children, of the Richmond area in Northern NSW, and indicative of the subtropical rainforest of the region. The image is also only one of three of the 319 in the volume that was not taken by the author.

In a work that is clearly the summation of more than 40 years of experience and research in the subtropical rainforests of Eastern Australia, much of it included in the Gondwana Rainforests of Australia World Heritage Area, Williams has produced a *tour de force*. In his consideration of the invertebrates of the subtropical rainforests he echoes Piotr Nasrecki (2005) in describing them 'the other 99 per cent', and correctly so, as never has so much so little considered by the lay person been of such importance.

The book presents well. It is printed (in China, I notice) on high quality paper and the text is clear. I was concerned to find a spelling mistake on page 1 of the Introduction but pleased it was one of very few. Thereafter, I was pleased to find Pangaea spelled correctly, as I frequently notice it is not, and an explanation of the use of the name Gondwana and term Gondwanan. The quality of the images in the plates, arranged six to a page, is generally good and there is no ink bleed between back-to-back images on subsequent pages as sometimes occurs in this situation.

As a botanist with particular interests in evolutionary processes and pollination ecology, I am pleased to see that Williams provides an overview of the former and numerous examples of the latter in respect to Australia's subtropical rainforests. In an informative Introduction Williams addresses the complexities of defining and describing subtropical rainforests and how he has approached the problem. In doing so, he provides a useful overview of previous thought on the matter. In addition, he puts them into context with boxed essays considering formation of the Gondwanan landmass, and the role of Alfred Russel Wallace, (the book starts with a dedication to him) of Wallace's Line fame, in founding the science and theory of biogeography. Given the Northern Hemisphere-centric of so much science and the fact that the small extent and narrow nature of both tropical and subtropical rainforests in Australia means that they do not display on images of the occurrence of rainforest at a global

scale, I consider both of the essays important inclusions in this volume. Williams also describes the extraordinary amount of clearing that has occurred of both tropical and subtropical rainforest in Australia, to the extent that ~65% of that in Queensland and ~75% of that in NSW are now gone. That which remains is often of small extent and disjunct and Williams addresses the effects of this in a discussion of the biological consequences of rainforest fragmentation in Chapter 3.

In respect of pollination biology in the Australian subtropical rainforest, Williams writes at length and, throughout his descriptions of the various invertebrate taxa, provides examples. This reflects the fact that Williams's PhD considered the pollination ecology of lowland subtropical rainforests in New South Wales.

The wide populace does not often consider the role or value of the 'other 99 per cent' and when they do it is often restricted to the insects. Williams provides a broad ranging, albeit in his words, a 'somewhat idiosyncratic' treatment, review of the invertebrates, including Crustacea and Mollusca. A check of the entry for one of my favourite groups, the Onycophora, reminded me that 29 of the 30 species known for Australia are endemic and Gondwanan relics. The breadth of material covered in this volume and the commentary on it is considerable and an indication of a lifetime's work. I found myself repeatedly delving into the text on disparate groups and being delighted and intrigued with what I found.

The Reference section of the book runs to 60 pages and a check by me of those areas I know best indicates that it is comprehensive. The most recent citations are for papers published in 2018, which given the time required for writing and publication, indicates an awareness of the recent literature. There are a few obvious errors, although experts in particular fields will likely find minor discrepancies; I am aware for instance that there is a recent series of papers that revise the Cicadoidea. However, these are minor quibbles and do not detract from the value of the book. A pleasing aspect of the volume is that Williams has included in Appendix 1 a discussion of the stygofauna, which has thus far been little studied in the subtropical rainforest ecosystems of Eastern Australia, despite the fact that those in the World Heritage Area are known to contain a significant concentration of stygofauna sites (Thurgate *et al.* 2001). I wonder what continuing fragmentation and drying, and the drawdown of water tables, including as a result of those in adjacent areas subject to fracking for gas extraction, will have on them.

At a time of continued clearing and isolation of habitat, and accelerating climate change and associated environmental effects, including unprecedented fires, the subtropical rainforests, already disjunct in nature, are under increasing stress. Williams convincingly makes the case for this and their attendant and often dependent invertebrate fauna, and in doing so, in parallel with the publications of others working in them, e.g. Kitching *et al.* (2010), emphasises the need for on-going conservation of and research in them.

In summary: A well-presented and useful volume for a wide range of scholars, students, and the generalist naturalist. Williams has made a valuable addition to our knowledge of a threatened ecosystem and is to be commended for his work. An associate to whom I briefly lent the review volume put it this way 'it contains a lot of information that will be of interest to a lot of people' and promptly ordered a copy. Speaking of ordering a copy raises my only real concern about the book; $195.00 is a lot of money. I realize that producing a high-class volume in limited numbers is a costly exercise but this price will limit sales of the book. It is prohibitive for students and most amateur enthusiasts, and will be challenging for both public and university libraries that are under financial constraints and tending to on-line resources. In the meantime, I will be recommending it to my associates and loaning it to students who would profit from it.

References cited

Kitching R.L., Braithwaite R., Cavanagh J., (Eds) (2010) *Remnants of Gondwana: A Natural and Social History of the Gondwana Rainforest of Australia*. Surrey Beatty and Sons, Baulkham Hills.

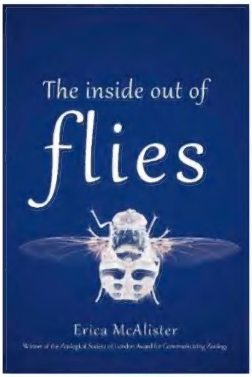
Nasrecki P., (2005) *The Smaller Majority: The Hidden World of the Animals that Dominate the Tropics*. The Belknap Press, Cambridge, Massachusetts.

Thurgate M.E., Gough J.S., Clarke A.K., Serov P., Spate A., (2001) Stygofauna diversity and distribution in Eastern Australian cave and karst areas *Records of the Western Australian Museum Supplement No.* **64**, 49-62.

Gary W Wilson
Biologist, Photographer and Traveller
Adjunct, Australian Tropical Herbarium
gwwilson064@gmail.com

****

The inside out of flies **by Erica McAlister.** CSIRO Publishing, Melbourne (for Australia and NZ). ISBN 9781486313808. 288 pages. Hardback - *September 2020* - AU $34.99 – Review by *Chris Lambkin*



An engaging romp through a compendium of little-known facts about the workings of flies.

This, the second popular science publication from Dr Erica McAlister, follows the acclaimed *The Secret Life of Flies* (2017) that won her the 2018 Zoological Society of London Award for Communicating Zoology.

Erica presents an amazing number of fly facts in a chatty style, clearly influenced by her skills in public engagement developed through her involvement with radio and Natural History Societies.

As Senior Curator of Diptera (including Siphonaptera) at the Natural History Museum in London, Erica is mostly

interested in mosquitoes, robber flies, and fungus gnats. However, that does not restrict the breadth of coverage of the fly world included in this book. It ranges from the tiniest blood sucking biting midge, through the world's biggest crane fly that spans 25.8 cm between foreleg and hindleg, to the massive wings in some male chironomids; from the most common house fly to the rarest mountain midges; from the most obscure 'bee-riders' that lack wings, halteres, scutellum, and ocelli to the weirdest bat fly whose mated female rips her wings and legs off, and even includes the bot fly rumoured to be travelling at 1,316 kmh.

The inside out of flies is well organised into nine chapters, together with an Introduction and 'The End'. In the first chapter, *Pre-adulthood*, we learn more than we ever needed to know about the immature stages of flies, from a detailed description of the 200 times more effective '*jumping*' escape in soft-bodied legless fruit-fly larvae to the incredibly successful '*debridement therapy*' where secretions from *Lucilia* maggots are invaluable in the treatment of chronic wounds. *Heads up* covers the information centre of the fly head from the crane flies '*heads superficially resembling that of Pluto, Micky Mouse's pet hound*', through the structure and working of the individual ommatidia of the compound eye, to the amazing patterns on fly eyes. *The Antennae* are treated separately in chapter 3, linking the variation of number, structure, shape, and size of sensilla to behaviour, survival, and even sex life. The incredible diversity of *Mouthparts* of both adults and immatures are covered in chapter 4, from the fossil *Archocyrtus kovalevi* with a proboscis twice the length of the body, to the current research on fly venoms. *The Thorax* outlines the importance of the structure of the cuticle, tracheal breathing system and spiracles, halteres, '*flight muscles and also the receptors to keep the fly level, helping it move to more favourable conditions and away from danger.*' The evolution, development, function, and structure of *The Wings* make up chapter 6, together with the terminology of venation, oscillation of halteres, and even the gustatory wing sensilla that help '*them detect food sources without landing'. Legs* includes a description of female biting midges that use their raptorial forelegs to grasp the male while they eat him while mating leaving '*torn-off male genitalia still attached to the females'*. Also included in chapter 7 is the work by Australians James Young and David Merritt on the silk production, for nuptial gifts, by glands in the swollen feet in balloon flies. *The Abdomen* covers the '*big flashy bottoms*', bacterial gut flora, Malpighian tubules, as well as the '*farts*' emitted by swarms of scavenger flies. Finally, *The Terminalia*, concentrates the numerous discussions of sexual behaviour throughout *The inside out of flies*, with a full-blown account of both male and female genitalia, clearly a favourite subject of Erica McAlister's, as she considers '*the genitalia of flies, both sexes, are so wonderful that they deserve a chapter all of their own.*'

This is not a lightweight book. *The inside out of flies* is jam-packed with facts and discusses both historic opinions and the most recent research, until the name dropping of the world's Dipterists almost becomes annoying. Unfortunately, while I found few scientific inaccuracies, there are many typographical errors missed by editors and proof-readers, disconcertedly concentrated at times in a particular section. Beautifully

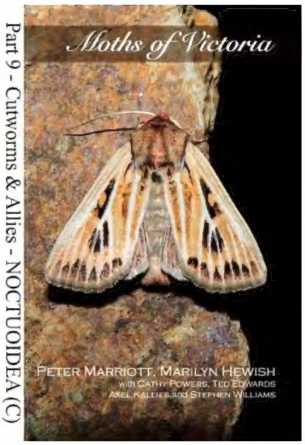
illustrated throughout, there are no references in the text to the relevant high-quality colour images, which are often separated by many pages. References are reported at the end of each chapter but, without explicit citation in the text, are sometimes difficult to link. While an easily read book, the chatty, quirky, contemporary style may become grating to some readers.

This is a small 'real' book; well-made, hard-cover, fully-stitched, with high-quality paper, and lovely to hold. The words and ideas in *The inside out of flies* flow smoothly. I found it easy to put-down and pick-up again later, and overall, an enjoyable read. I recommend *The inside out of flies* to anyone interested in nature – this book promises a very different learning experience!

Chris Lambkin
Queensland Museum (Dipterist)

****

Moths of Victoria Vol 9 – Reviewed by *Peter Hendry*


Moths of Victoria
Part 9 - Cutworms & Allies - NOCTUOIDEA (C)
Peter Marriott, Marilyn Hewish
with Cathy Powers, Ted Edwards
Axel Kallies and Stephen Williams

Moths of Victoria Volume 9 is the latest installment in this ongoing series attempting to document all the moth species occurring in Victoria. This volume is the third and last volume covering the large superfamily Noctuoidea and deals with about 220 members of the family Noctuidae from the subfamilies, Plusiinae, Acronictinae/Amphipyrinae, Noctuinae (including Hadeninae as the tribe Hadenini) and Heliothinae.

The booklet, as per other volumes, includes images of set specimens of all species dealt with in this volume, along with many examples of live adults and several images of larva.

The CD which accompanies the booklet contains some 440 pages dealing with the species involved as well as a General folder which contains information about the authors and photographers; notes on the photographs; an index; references; updates to previous volumes and a preview to the contents of the next volume. On the CD each specimen is generally represented by images of set specimens of both male and female with their lable data, flight times, shown graphically, and distribution, represented by a range map of their Victorian distribution and a note on which other states they occur in. Many are also represented by images of live moths with the locality at which the image was taken. Images of the larva of many species are also included along with the host plant being noted in some cases.

Also on the CD, the distinguishing features of several species are clearly marked and noted and the differences between similar species are also pointed out. There are three pages, with illustrations, discussing the difference between the closely aligned

genera, *Proteuxoa* and *Thoracolopha*. It is this sort of data that is most useful in identifying many difficult to separate species and which is mostly missing from other publications.

I can highly recommend this volume and the previous 8 to anyone with a passing interest in nature or those specifically interested in identifying Australian moths in general, as many of the Victorian species are found in other states and some Australia-wide.

At $12 each, plus postage this is a value packed publication. An order form can be found on the website below:
HTTP://ENTSOCVIC.ORG.AU/?PAGE_ID=52

SEED BANK

Alternanthera denticulata
Aristolochia acuminata (Tagala)
Aristolochia macroura
Asclepias curassavica
Asystasia gangetica
Brachychiton populneus
Crotalaria grandiflora
Hygrophila angustifolia
Melicope elleryana
Senna acclinis
Senna gaudichaudii
Senna retusa var. *glabra*
Sesbania cannabina

There are small quantities of host plant seeds available. If you require any of them, please send a stamped, self-addressed envelope to Daphne Bowden, 24 Rickston Street, Manly West Qld. 4179 and list the seeds you require.

DISCLAIMER

The magazine seeks to be as scientifically accurate as possible but the views, opinions, and observations expressed are those of the authors. The magazine is a platform for people, both amateur and professional, to express their views and observations about invertebrates. They are not necessarily those of the BOIC. The manuscripts are submitted for comment to entomologists or people working in the area of the topic being discussed. If inaccuracies have inadvertently occurred and are brought to our attention, we will seek to correct them in future editions. The Editor reserves the right to refuse to print any matter which is unsuitable, inappropriate or objectionable and to make nomenclature changes as appropriate.

ACKNOWLEDGEMENTS

Producing this magazine is done with the efforts of:

- Those members who have sent in letters and articles
- Peter Hendry who provided the cover photo collage
- Daphne Bowden who works on layout, production, and distribution
- John Moss, Peter Hendry, Geoff Monteith and Ross Kendall for scientific referencing and proof-reading of various articles in this issue of the magazine